as well as its cultural characters are so distinctive as to leave no doubt as to its identity. The fungus collected by Meyer at Nikko is unquestionably *Endothia parasitica.*

The above statement was completed and submitted for publication December 23, 1915. During the interval following, several specimens of fungi from Japan have been received by the writers which are of such interest in connection with the observations recorded above that it seems desirable to add them. On December 27, 1915, there was received from the Federal Horticultural Board a specimen of diseased chestnut nursery stock (their number 947), which had been sent by H. M. Williamson, secretary of the State Board of Horticulture at Portland, Oregon.

In the letter transmitting the specimen Mr. Williamson states that it was from

> an importation of nursery stock . . . grown at Kanagawa-Ken, Yokohama, Japan. . . . Included in this shipment were some chestnut trees and five of the chestnut trees were diseased. . . . Four of the chestnut trees have been burned and I am mailing you the other diseased tree under separate cover.

The fungus, which showed only pycnidia, has been cultured and is apparently the same as that found on the chestnut seedlings condemned at San Francisco in February, 1915, and mentioned above, and which was also found on the specimen brought from Japan by Swingle.

A small specimen of an *Endothia* collected at Nikko, Japan, September 17, 1915, on bark of *Pasania* sp. (*Quercus* of some authors), has been recently transmitted to the writers by Mr. Frank N. Meyer. This specimen shows typical ascospores of *Endothia radicalis* (Schw.) and in cultures proved identical with those of *Endothia radicalis* collected in this country. This collection seems to leave no doubt that *E. radicalis* is indigenous in Japan and that there as in Europe and America it is not confined to *Castanea.*

January 8, 1916, the writers received from Dr. Gentaro Yamada, of the Morioka Imperial College of Agriculture and Forestry, two specimens, one labeled "on *Quercus crispula.* Mt. Moriva, near Sapporo, Hokkaido, Japan. March 27, 1897. Coll. G. Yamada & T. Totsu," the other labeled "*Endothia parasitica* on *Castanea vulgaris* Lam. var. japonica DC. Morioka, northern Japan. Dec. 5, 1915. Coll. G. Yamada." The fungus on *Quercus crispula* was of course no longer viable. It contained, however, abundant ascospores which agree in their measurements with those of *Endothia radicalis.*

The specimen on *Castanea* is typical *Endothia parasitica,* as shown by the mycelial fans, pycnospores and ascospores, and by cultures. This specimen shows hypertrophy of the tissues very similar to that produced by the fungus on American chestnuts. In the letter accompanying this specimen, dated December 15, 1915, Dr. Yamada says he found the specimen of *E. parasitica* on his first collecting trip after his return to Japan. In this connection it may be stated that during his recent visit to this country Dr. Yamada spent some time with the writers in examining specimens of *Endothia parasitica* and other species of *Endothia* and took back with him typical specimens. This probably accounts for his finding the fungus so quickly.

C. L. Shear,
Neil E. Stevens
Bureau of Plant Industry,
Washington, D. C.

THE AMERICAN SOCIETY OF ZOOLOGISTS. II

GENETICS

Sex Controlled in Rotifers by Food (illustrated by lantern): D. D. Whitney, Wesleyan University.

Several species from two of the five orders of rotifers have yielded very positive results. All female offspring were produced under certain food conditions and from 30 per cent. to 95 per cent. male offspring were produced under certain other food conditions. In some of the species the offspring were all females when the race was fed upon a diet of colorless flagellates, but when the race was suddenly put upon a diet of green flagellates a high percentage of male offspring appeared. In other species a scanty diet of green flagellates produced all female offspring while a

copious diet of the same green flagellates produced as high as 95 per cent. of male offspring, thus showing that it is the quantity of the food that regulates the production of the sexes and not the stimulus of a change of food.

Male-production in Hydatina Favored by Oxygen: A. FRANKLIN SHULL AND SONIA LADOFF, University of Michigan.

Whitney's experiments of a year ago, in which feeding these rotifers on the green flagellate *Chlamydomonas* resulted in greatly increased male-production, left room for doubt whether other agents than nutrition might not be producing part of the effects noted. The food cultures were differently constituted at the outset, and the organisms reared in them may have produced secondary differences. We have attempted to test some of the possible factors other than nutrition. So far our results may be interpreted largely in support of Whitney's conclusion; for, while one of the suspected agents has been found to increase male-production, its effect is not so marked as that in Whitney's experiments. The one effective factor discovered is oxygen. Under several different conditions, oxygen produced uniform effects of moderate degree.

On the Inheritance of Size in Paramecium: JAMES E. ACKERT, Kansas State Agricultural College.

A series of experiments with *Paramecium caudatum* and *P. aurelia* was carried on with a view to determining the effect of selection within the progeny of a single individual. In 1911, when these experiments were begun, the excellent work of Jennings had already been reported; but, to test this principle, independently, using large numbers of individuals, seemed justifiable. In a typical experiment a single *Paramecium* was isolated on a depression slide in a few drops of hay infusion. After several generations there were isolated from its descendants two *Paramecia*—one, the shortest of the progeny, the other, the longest. The descendants of each of these individuals were kept in separate receptacles under environmental conditions as nearly identical as possible. At a later time all but a few of the animals of each group were killed and measured. In all of the experiments, except one, the images of the *Paramecia* were thrown upon a screen with a combination microscope and lantern, giving a magnification of 3,200 diameters. The usual methods of dealing with statistical data were used in the preparation of the results. In all cases the effect of the selection within the progeny of a single individual was negative. In some instances the difference in mean lengths of the groups under comparison fell within the probable errors of the means; in others the mean lengths of the progeny of the smaller *Paramecia* were larger than those of the descendants of the larger *Paramecia*. The conclusion is based upon measurements of nearly 6,000 *Paramecia*.

The Influence of Selection on the Number of Extra Bristles in Drosophila: E. CARLETON MACDOWELL, Carnegie Institution of Washington.

Previously it has been shown that the extra bristles that characterize a certain race of *Drosophila* are conditioned by a Mendelian determiner; that the exact number of extra bristles is not inherited, but varies in relation to external conditions; that, in spite of this, the selection of high variates as parents, continuously raised the averages of the race for several generations, after which no further progress could be determined. The present report carries the selection for increased numbers of bristles to the forty-sixth generation. In certain of the later generations the averages have been raised by more favorable conditions and by counting only the large flies that hatch at the first of a bottle, the flies at the end of a bottle being smaller and with fewer bristles. The upper limits of the distributions would not be influenced in the same way, and so offer a better test for the effect of selection. These upper limits show no tendency to advance after the first few generations. Two series of return selections have been made, from the sixteenth and twenty-seventh generations. These failed to show any lowering of the averages, although carried on for six and eight generations, whereas the initial rise of the averages was immediate. The distribution of extra bristles extracted from a cross with normals is lower than that of the corresponding inbred generation. A race of low grade has been established from extras extracted from a cross. This race averages about two bristles lower than the high-selected race. If, as formerly proposed, the initial rise in the averages was due to a sifting out of secondary determiners, all the above results would be expected.

Twinning in Cattle, with Special Reference to the Free Martin (illustrated with lantern): LEON J. COLE, College of Agriculture of Wisconsin.

A study of 303 multiple births in cattle, obtained directly from breeders. The records include: 43 cases homosexual male, 165 cases recorded heterosexual (male and female), 88 cases

homosexual female, 7 cases triplets, a ratio of twins of approximately 1:4:2 instead of the 1:2:1 expected if there were no disturbing element entering in. The expectation may be brought more nearly into harmony with the facts if it is assumed that in addition to ordinary fraternal (dizygotic) twins there are numbers of "identical" (monozygotic) twins of both sexes, and that while in the case of females these are both normal, in the case of a dividing male zygote, to form two individuals, in one of them the sexual organs remain in the undifferentiated stage, so that the animal superficially resembles a female and is ordinarily recorded as such, although it is barren. The records for monozygotic twins accordingly go to increase the homosexual female and the heterosexual classes, while the homosexual male class, in which part of them really belong, does not receive any increment. This brings the expected ratio much nearer the ratio obtained.

Any female calf twinned with a male is referred to as a free martin. According to the interpretation given, some free martins should be fertile, while others are sterile. It was found that both classes exist.

CYTOLOGY

The Mitochondria in the Germ Cells of the Male of Gryllotalpa borealis: F. PAYNE, Indiana University.

The mitochondria are present in the spermatogonial cells in the form of granules lying at one side of the nucleus and between the nucleus and cell wall. In the early growth-period the granular appearance is replaced by a thread-like arrangement. The threads are grouped into a mass and lie in contact or near the nucleus. They remain in this position and condition throughout the growth-period. In the prophase of the first maturation division the threads come out of the mass and as the spindle forms they take up a position outside the spindle, but extending about half-way round it. The threads are almost as long as the spindle. After the chromosomes have reached the ends of the spindle the elongated mitochondrial threads seem to break near the middle, part of them moving along the spindle toward one pole and part toward the other. The threads seem to be approximately halved. In the second division a similar process takes place. Each spermatid, then, receives a mass of mitochondria. In the transformation of this spermatid into a spermatozoon the mitochondria take part in the formation of the tail, but nothing more.

Pairing of Chromosomes in the Diptera: CHAS. W. METZ, Carnegie Institution of Washington. (Introduced by C. B. DAVENPORT.)

A study of the chromosomes in about 75 species of Diptera, ranging from among the lowest to the highest in the order, reveals the following facts:

First, a paired association of chromosomes is found to exist as a normal condition in all species studied.

Second, the two members of each pair of chromosomes are homologous elements, of respectively maternal and paternal derivation.

Third, the association of homologous chromosomes into pairs occurs at a very early stage in ontogeny (before cleavage is completed) and persists throughout the larval, pupal and adult life of the fly.

Fourth, the paired association is found in all diploid cells, somatic as well as germinal.

Fifth, it apparently persists throughout all stages in the growth and division of each cell, being evident from earliest prophase to latest anaphase.

Sixth, to account for this side-by-side approximation of homologous chromosomes exhibited by the flies something more than purely mechanical forces must be taken into consideration.

The data indicates that pairing must depend upon the qualitative nature of the chromosomes. From this, and the fact that paired chromosomes are homologous chromosomes, the evidence is seen strongly to support the hypothesis that homologous chromosomes are qualitatively similar and that non-homologous chromosomes are qualitatively different in their make-up, and that therein lies the secret of Mendelian heredity.

Chromosome Individuality in Fish Eggs: A. RICHARDS, University of Texas.

The observation of Miss Morris, that the chromosomes from the two parents can be recognized in *Fundulus* eggs fertilized with *Ctenolobrus* sperm is verified. Furthermore, even in the telophases of cleavage mitoses it is possible to recognize clearly the chromosomal vesicles as separate bodies, and in the resting nuclei the parts contributed by the individual chromosome can be distinguished without difficulty. Treatment of the eggs or sperm before or after fertilization by X-rays serves to emphasize this distinctness.

Studies on the Chromosomes of the Common Fowl (illustrated with lantern slides of photomicrographs): M. F. GUYER, University of Wisconsin.

My later studies, extending over a period of more than ten years, afford abundant confirmatory evidence of my earlier findings that in the spermatogenesis of the common fowl, a large curved chromosome, comparable to the sex-chromosome of other forms, typically passes undivided to one pole of the spindle during the division of the primary spermatocyte. To determine what form this element assumes in the somatic cells of male and female fowls, a study of the cells of embryo chicks was undertaken. In the main chicks of 10, 13 and 20 days of incubation were used. The cells studied were, for the most part, those of the developing nephridial tubules, the nervous system and the gonads. Two fairly well marked curved rods —easily discernible from the other chromosomes— were found to occur with great frequency in the cells of the male. A reexamination of spermatogonia of both the common and the guinea fowl revealed similar paired elements. In the female in a significant percentage of cases only a single element of like appearance could be found. Thus, for this element, the male appears to be homozygous, the female heterozygous. The large curved element of the primary spermatocyte would seem to be in reality, therefore, a double element formed by the fusion of the pair of curved chromosomes which exist independently in somatic and early germ-cells. However, the passing over of this element undivided in the first maturation division brings about a condition of dimorphism in the later male germ cells. An important point to be substantiated yet is whether one class of these degenerate without forming spermatozoa, or, if forming them, whether they are not sterile.

EMBRYOLOGY

Fish Hybridization an Instrument in Morphogenetic Research: H. H. NEWMAN, University of Chicago.

During the past ten years experiments in fish hybridization have engaged a considerable share of my attention and I have been strongly impressed with the possibilities offered by this field of experimentation. Practically any type of morphogenetic disturbance that has been obtained by physical or chemical means is duplicated in some common teleost hybrid. Certain crosses give all of the grades of optic anomaly described by Stockard and others as due to various anesthetics. Double-headed, double- and triple-tailed monsters, etc., are very numerous in some crosses and the genesis of these conditions could be readily studied in living material.

Among the most interesting anomalous conditions seen in these hybrids are the various disturbances in the relations of parts of the vitelline and systemic circulation. The heart and its main vessels frequently appear disjoined from the body, and exhibit an independence in differentiation and an automaticity truly striking. Many problems might be cleared up by a study of these conditions.

The various developmental blocks in hybrid crosses are of considerable general interest, especially to the experimental embryologist. The fact that the end of the cleavage period is the commonest block to hybrid development is significant in the interpretation of the physiology of cleavage and of gastrulation.

Other blocks such as those occurring during gastrulation, especially those involving disturbances of the mechanism of concrescence, are scarcely less significant.

Apart from hybrid results per se the hybridization method itself is of much broader application for experimental biology.

Structure and Function in the Development of the Special Senses in Mammals: H. H. LANE, University of Oklahoma.

By physiological experimentation upon the embryo and fetus of the rat and other mammals at different stages in their development, the time when each of the special senses—touch, equilibrium, taste, smell, hearing and sight—first becomes functional has been determined within relatively small limits of probable error, and a study made of the corresponding structural development. Considering a reflex arc involving any special sense, it has been found that the association centers, the afferent and efferent nerve-trunks, and the effective motor apparatus are all in working order before the special sense organ concerned is capable of functioning, *i. e.*, the organ of special sense is in each case the last link in the chain to be perfected, and in each case the function is established when (and only so soon as) the proper peripheral sense organ has reached its functional state. The order of development of the organs of special sense and their correlated mechanisms is not that demanded by a Lamarckian hypothesis. It seems evident from these investigations (which are being extended) that the development of the nervous system in general and the differentiation of its constituent parts are due not to *epigenesis,* but to *endogenesis,* or predetermination in the oosperm; that these structures appear not as direct responses to the needs of the embryo, but in anticipation of those needs; not under the influence of their spe-

cific, definitive environmental stimuli, but because of the inherited organization and forces in the oosperm, which can only be secondarily modified or controlled by other factors.

The Development of Recurrent Bronchi and of Air Sacs of the Avian Lung: Wm. A. Locy and Olof Lassell, Northwestern University.

The notable observations of Schulze (1911) and of Juillet (1912) have brought forward a newly recognized structural element—the recurrent bronchi—known only in the lungs of birds, which imparts a renewed interest in the structural peculiarities of the avian lung and in the physiology of its air-sacs. The development of these recurrent bronchi, beginning as buds on the air-sacs and growing into the lungs, as illustrated by the lantern slides, and the condition of the recurrent bronchi of the adult lung is shown by Wood's metal casts. The formation of bronchial circuits within the lung by the union of recurrent bronchi with branches of other bronchi is indicated, and the probable physiology of the air-sacs is briefly considered.

Regarding the development of the air-sacs, the interclavicular is shown to arise from four separate moieties, two from each lung, which later unite to form the single median sac of the adult. The lateral moieties of the interclavicular sac have long been recognized, but the existence of separate mesial moieties and the manner of the union of the four parts is believed to be presented for the first time.

COMPARATIVE ANATOMY

The Olfactory Organs of Lepidoptera: N. E. McIndoo, Bureau of Entomology.

The organs discussed in this paper are the olfactory pores, already described by the writer for the Honey Bee, Hymenoptera and Coleoptera in other papers. The present paper deals with only the morphology of these organs in Lepidoptera.

As usual, the olfactory pores are found on the legs, wings and mouth-parts. Two groups are always present on each trochanter; one group usually on each femur; a few scattered pores generally on each tibia, some of these sometimes being in the tibial spines; one to four groups on the base of each wing, besides scattered pores usually extending the full length of the wing; and a few pores on the mouth-parts.

The total number of olfactory pores varies from about 500 to 1,300. Moths usually have more pores than butterflies. Based on the total number of pores, the individual, sexual and specific differences are slight, while the generic differences may or may not be slight, the latter differences depending on the sizes of the specimens compared.

The olfactory pores are flask-shaped structures, and those on the wings have been called dome-shaped organs because the chitin surrounding each pore aperture is arched dome-like above the general surface of the wing. As usual, chitinous cones are present and the sense cells are spindle-shaped. In distribution and structure the olfactory pores of Lepidoptera are more similar to those of Hymenoptera than to those of Coleoptera.

The Structure of Agelacrinites, a Fossil Echinoderm (Cistoid) of the Richmond (illustrated with lantern): S. R. Williams, Miami University.

1. Agelacrinites was probably somewhat motile—at least able to adapt its peripheral rim to its surroundings.

2. The peripheral rim may have been extensible.

3. The animal probably breathed by muscular protraction, extension and retraction of the anal pyramid, getting oxygen by rectal respiration.

4. The probable path of the alimentary canal in the young animal.

5. Cover plates and floor plates of the brachial grooves and their patterns.

Neuromeres and Metameres: H. V. Neal, Tufts College.

The paper summarizes observations upon the nidular relations of cranial nerves in *Squalus* embryos and raises the problem, Are neuromeres reliable criteria of the primitive metamerism of the vertebrate head?

The motor nidulus of the trigeminus lies in the second and third hind brain neuromere (rhombomere); that of the facialis extends through four rhombomeres, viz., the fourth, fifth, sixth and seventh. The nidulus of the glossopharyngeus lies in the sixth and seventh rhombomeres, while that of the vagus extends from the posterior part of the seventh for a considerable distance in the unsegmented portion of the medulla.

Of the somatic motor nerves, the nidulus of the oculomotorius lies in the midbrain; that of the trochlearis lies primarily in the first (cerebellar) rhombomere; that of the abducens extends through the sixth rhombomere and somewhat into the two adjacent ones. The nidulus of the hypoglossus lies in the unsegmented portion of the medulla posterior to the seventh rhombomere.

Somatic motor niduli lie primarily dorso-lateral

to splanchnic motor niduli. Secondarily by migration (neurobiotaxis) these relations are reversed as in mammals (Graeper, '13).

The connection of four rhombomeres with a single visceral arch (the hyoid), and of three visceral arches with a single rhombomere (the seventh) is a fact not easily reconciled with the assumption that a single rhombomere was originally connected by a splanchnic motor nerve with a single visceral arch.

The Spines of Catfishes (illustrated with lantern): H. D. REED AND T. J. LLOYD, Cornell University.

The following observations upon the spines of catfishes were made chiefly upon the pectoral fins of *Ameiurus nebulosus* and various species of *Schilbeodes*, and are incidental to another study. In an attempt to determine the morphology of certain soft parts of the fins of catfishes it became obvious that there existed a definite relation to the morphology of the spines. A search of the literature revealed only such statements as "the spines are believed to represent a fusion of soft rays" rather than the ankylosis of the lepidotrichia of a single soft ray as in the true spiny-rayed fishes.

A study of the mature spines and developmental stages shows that the spines of the catfishes examined represent a fusion of several soft rays. The rays contributing to the formation of spines arise in the typical fashion and the fusion of rays as well as the lepidotrichia is from the base toward the free end. The cavity of the spine represents the distal (cephalic) half of the space found normally between the individuals of the fused pairs of lepidotrichia. The last ray, in young individuals, at least, is free for its distal half where it is segmented and bifurcates, as do the unmodified soft rays.

MISCELLANEOUS

A New Method of Observing the Bronchial Tree of the Embryonic Lung: WM. A. LOCY AND OLOF LASSELL, Northwestern University.

The difficulties of observing early stages of the bronchial tree of the embryonic lung are considerable. Wax reconstructions, celloidin injections and Wood's metal casts have unfavorable limitations.

A simple method is now available by the modification of a method of an injection originated by Hochstetter in 1898, for study of the semicircular canals of the ear. The lungs are dissected out of fixed and hardened specimens and cleared in thick cedar oil, after which they are immersed in a mixture of one part thick cedar oil and two parts chloroform. After thorough penetration, the specimen is removed from the mixture and placed on a filter paper until the chloroform evaporates. This serves to draw the cedar oil from the various branches of the bronchial tree and to fill the spaces with air. When the air-filled preparation is immersed in pure cedar oil the entire bronchial tree presents the appearance of being filled with a bright metallic cast and can be readily observed through the translucent walls of the lung. The minuter air passages are permeated, and, although the smallest ones disappear in a few minutes as the cedar oil percolates into them, the same specimen, if carefully manipulated, can be treated repeatedly without apparent injury. Results of this method are illustrated by lantern slides.

The Parasitic Fauna of the Bermudas: FRANKLIN D. BARKER, University of Nebraska.

The preliminary study of the animal parasites collected in the Bermudas during the summer of 1912 has been completed. A brief summary of the parasites found is as follows:

Parasite	Number of Species Found		Host
1. Protozoa	1		Toad
2. Trematoda			
A. Encysted	2		2 species of fish
B. Ectoparasites	2		9 species of fish
C. Endoparasites	44		23 species of fish
"	2		2 species of sea-cucumber
3. Turbellarias endoparasites			
4. Cestoda			
A. Mature	0		0
B. Immature (free)	2		6 species of fish
C. Immature (encysted)	5		14 species of fish
5. Nematoda			
A. Mature	3		7 species of fish
B. Immature (free)	3		10 species of fish
C. Immature (encysted)	2		5 species of fish
6. Acanthocephala	3		7 species of fish
7. Crustacea			
A. Copepoda	Undetermined		10 species of fish
B. Isopoda	Undetermined		5 species of fish

This study has been intensive for a comparatively small number of individuals rather than a superficial examination of a large number, with the result that the parasites found are all in first-class condition for detailed study. This has made it possible for us to add ten new species of trematodes, two new species of nematodes and one new species of acanthocephala to the large list of helminthes found in the fishes of the Bermudas and the Dry Tortugas by Linton (1908; 1910). We have also been able to add considerably to the meager descriptions of some species as well as to identify a number of Linton's undetermined species.

This and future intensive study of the parasitic fauna of the Bermudas has been made possible through the assistance of the Museum of Comparative Zoology of Harvard University and the Bache Fund of the National Academy of Sciences.

Increase in Opportunities for Work at the Bermuda Biological Station (illustrated with lantern): E. L. Mark, Harvard University.

By a recent agreement between the Bermuda Natural History Society and Harvard University, the Bermuda Biological Station for Research, which has hitherto been in operation for only six or eight weeks each summer, is now to be open throughout the year. Harvard has appointed Dr. William J. Crozier, resident naturalist and Mrs. Crozier, librarian and recorder. Dr. and Mrs. Crozier are living in one of the cottages on Agar's Island, where the station and the Bermuda Public Aquarium are located. The new arrangement will permit the investigation of classes of problems which could not be undertaken during a sojourn of a few weeks in midsummer, and will give opportunity to study seasonal variations as well as the times of fruiting and spawning. Not the least of the advantages resulting from this change is the opportunity it will give biologists to carry on work at a midocean station at any time of the year when they may choose to avail themselves of it.

The laboratory has accommodations for about a dozen investigators. It is not proposed at present to charge any fee for the privileges of the station. The purpose is to provide facilities for persons who are competent to carry on original work, and for such only; no instruction is offered; and the station is not to be used for the purpose of making miscellaneous collections of commercial value. The staff of the station will endeavor to procure and prepare at moderate cost material needed for investigations or for use in teaching.

Having completed the papers listed on the printed program, the following papers, received too late to be printed on the program, with the consent of the society were read:

The Cranial Nerves of an Adult Cœcelian: H. W. Norris, Grinnell College.

Two types: (1) Eye covered by the maxilla, eyeball very rudimentary, no optic nerve, no eye-muscle nerves, except abducens, no eye-muscles; (2) Eye not covered by maxilla, shows characteristic structure with nerves and muscles. Abducens in both innervates the retractor tentaculi muscle.

Lateral line components absent. Olfactory nerve apparently double, but actually merely exaggerating the condition found in other Amphibia. Two ganglia on trigeminal-nerve, as noted by previous writers. General cutaneous component in facial nerve, blending anteriorly with the trigeminal.

Previous writers (Marcus excepted) have represented posterior to the seventh and eighth nerves a complex with very puzzling characteristics. Resolved into its components this complex consists of: a ramus jugularis VII. that extends far back in the body to innervate the sphincter colli muscle; a sympathetic trunk, with two large ganglia, that has its origin in the gasserian and facial ganglia and reaches far beyond the posterior limits of the head; the IX.–X. nerve trunk with two distinct ganglia; an occipital nerve that passes through the posterior part of the first IX.–X. ganglion; the first, second and third spinal nerves, the first of which gives origin to the hypoglossal nerve, the second of which sends a branch through the second sympathetic ganglion, and the third of which sends a branch into the posterior tip of the same ganglion.

The Advancing Pendulum of Biological Thought: C. C. Nutting, State University of Iowa.

The figure of an advancing pendulum correctly represents the course of scientific progress. The alternate swings to right and left culminate in extreme positions, but the net result is a real advance.

The NeoDarwinian swing led by Weismann. Its extreme position and the net gain.

The NeoLamarckian swing led by the "American School." The extreme position of E. D. Cope and the net gain.

The Mendelian swing led by Bateson, Castle and others. The extreme position of Bateson. A biological justification of the theological doctrines of foreordination and regeneration. The net gain.

General principles deduced from this discussion.

The pendulum of thought never retraces its course; but there is regularly a net gain.

The extreme position, or furthest point of each swing, is almost invariably wrong.

Each leader contributes something real to progress, and it is unwise to utterly discredit him. Witness Morgan and pangenesis.

The return from the extreme of the Mendelian swing. Witness Castle and E. B. Wilson.

The position of the systematist under present conditions.

A Case of Sex-Linked Inheritance in Man: HANSFORD MACCURDY, Alma College.

In the history of a certain family in Michigan, there occurs a most interesting case of the transmission of a peculiar character, which manifests itself at the approach of maturity in a certain proportion of the males. It makes its appearance only after a long series of complex physiological processes and in a remote period of development. The factors are evidently not simple, and possibly may manifest themselves in various ways; but the particular character here noted affects the feet of males in a definite proportion.

An affected male does not transmit the factor or factors to his sons. He transmits them through his daughter married to a normal male through four out of five of his granddaughters, and through these to half of their sons.

According to the chromosomal hypothesis of control of development and heredity this is a case of sex-linked inheritance and is limited to one half of the sons of the daughters of affected males. It also indirectly points to the transmission of characters or factors detrimental to one sex.

The Components of the Cerebral Ganglia and Nerves of a 23 mm. Embryo of Squalus Acanthias: F. L. LANDACRE, Ohio State University.

The 23 mm. embryo of *Squallus* was selected because it is sufficiently developed to enable one to recognize the principal nerves and determine their composition while the ganglia are still fairly well separated so that their boundaries can be determined. The chief ganglia and nerves are found to be typical for Ichthyopsida in general. Some of the peculiarities noted are the very small size of oph. sup. V.; the separateness of the lateral lines organ primordia; the large size of the epibrachial placodes; the precocious character of the lateral line nerves as compared with other nerves. The analysis, which can be shown briefly only by means of a diagram, is offered tentatively in the absence of a published analysis of a more mature individual.

Silk Spinning in Its Relation to the Feeding Habits of Chironomus lobiferus Say: ADELBERT L. LEATHERS, Cornell University.

The larvæ of *Chironomus lobiferus* were found inhabiting the air cavities of the living stems of *Sparganium* sp., which they penetrate by boring two small openings through the epidermis. Here they maintain suitable living conditions by a regular undulating motion of the body which sets up a current of water through the burrow. An examination of the stomach contents showed the food to be plankton and not the tissue of the plant. It was found that these larvæ will adapt themselves to living in glass tubes, and under such conditions careful observation revealed a conical net fastened at the base to the silken lining of the larval gallery and held extended by radiating threads attached to its apex. This net is made to bulge out by the pressure of the current forced into it. The smaller particles become tangled in its meshes and the protozoa, diatoms and other unicellular algæ are largely removed, although some escape through gaps near the rim of the net. When this current has been maintained for about ten minutes, regardless of the amount of food in the net at any time, the larva turns about in its burrow and grasps one edge of the net and forces it into its mouth, then rotates its body and grasps another part, and so on until the net is entirely swallowed. Then it spins another, spreading and attaching the silk by its anterior prolegs; turns about and begins the undulating motion again.

The Resistance of Starved and Normal Fishes to Low Oxygen and the Effect upon this Resistance of Acids, Alkalies, Salts, Etc.: MORRIS M. WELLS, University of Chicago.

The resistance of normal fishes to various concentrations and combinations of oxygen and carbon dioxide was determined in 1913 (*Biol. Bull.*, Vol. 25) and since that time an improved apparatus has been devised and the resistance of starved fishes at different periods during the starving process has been determined. The work is being pushed further in an attempt to determine the relation of the oxidations of the fishes to the presence of other substances in the water. The effects of acidity and alkalinity have been compared, the dying time in running and stagnant water has been determined and the work that is now under way contemplates the determining in the next three weeks of the effect upon the resistance of the fishes of the presence of various salts and sugars, and a comparison of the effects of KCN as compared with low oxygen.

Results already obtained:

1. An apparatus that will furnish a flow of about one liter of oxygen-free water per minute.

2. A determination of the seasonal resistance of fresh-water fishes to low oxygen.

3. The resistance curve of starving fishes which live without food for three to four months. This curve shows a rise in the resistance of the fishes, *i. e.*, a decrease in their susceptibility, during the first part of the starving period; this increase in resistance lasts for from three weeks to two months and then the resistance usually falls off very rapidly and the fish soon dies of starvation.

4. The rate of actual loss of weight in starving fishes has been determined by consecutive weighings, and a comparison of loss of weight and its effects upon resistance in young and old fishes has been made.

5. It has been determined that the reaction of the water, *i. e.*, whether alkaline or acid, has a marked effect upon the resistance of the fishes and the alkaline water seems to be considerably more toxic than the acid in such small concentrations as $N/3{,}000$ or thereabouts.

6. When the water is alkaline fishes live longer if corked up in the low oxygen water than they do if the water flows constantly through the experimental bottle.

It is expected that some further data will be ready for discussion by the time of the Christmas meeting, as the experiments are being run daily.

Chromosomes in Relation to Taxonomy in the Tettigidæ: W. R. B. Robertson, University of Kansas. (Introduced by B. M. Allen.)

Experimental Modification of the Development of the Germ Cells of Rana: B. M. Allen, University of Kansas.

Compound Chromosomes in Charthippus curtipennis: W. R. B. Robertson, University of Kansas. (Introduced by B. M. Allen.)

Exhibits

The society adjourned, after its session for the transaction of business, on the afternoon of Wednesday, December 29, to examine and discuss the following exhibits which had been arranged in the bacteriological laboratory on the second floor of the Veterinary Building:

Elementary Color Patterns and Their Hybrid Combinations in Grouse Locusts, Robert K. Nabours, Kansas State Agricultural College.

Photographs Illustrating (I) *Experimental Alteration in the Direction of Growth of a Silicious Sponge* (*Stylotella heliophila* Wils.), (II) *Pseudopodia in Sponge Plasmodia Formed from Dissociated Cells,* (III) *Canals and Pores that have Developed in a Sponge Plasmodium,* H. V. Wilson, University of North Carolina.

In the common type of this sponge there is a basal body produced upward into vertical lobes bearing oscula at the summit. If such a sponge be laid on its side, the original oscula gradually close and disappear, while new vertical lobes grow up toward the surface of the water, at right angles to the original lobes. The new lobes bear oscula at the summit.

Wood's Metal Casts of the Recurrent Bronchi of the Adult Lung of the Chick, Wm. A. Locy, Northwestern University.

Sections Showing Pairing of Chromosomes in the Diptera, Charles W. Metz, Carnegie Institution of Washington.

(1) *A Portable Diagram Holder,* (2) *Laboratory Dissecting Pan,* E. L. Mark, Harvard University.

Model of the Pectoral Spine of Ameiurus, H. D. Reed, Cornell University.

Charts and Specimens Demonstrating the Nature of the Intercellular Connective Tissue Substance, Raphael Isaacs, University of Cincinnati. (Introduced by H. McE. Knower.)

Slides for Demonstrating Chromosomes of the Common Fowl: M. F. Guyer, University of Wisconsin.

Symposium

At the session held during the forenoon of Thursday, December 30, a symposium on the topic "The Basis of Individuality in Organisms," was held, C. M. Child, O. C. Glaser and H. V. Neal reading papers, the first speaker approaching the problem from the point of view of the physiologist, the second from that of the physical-chemist, the third from that of the vitalist. Illness in the families of E. G. Conklin and C. E. McClung prevented their attendance. The paper prepared by E. G. Conklin was in the hands of the secretary, but, for want of time, it was not read. It was evident that those who took part in the symposium had given much time and thought to the subject and in the preparation of their papers[1] and a vote of appreciation of their efforts to make the meeting a profitable and enjoyable occasion was voted by the society, and then adjourned *sine die.*

Caswell Grave,
Secretary-Treasurer

[1] It is hoped that these papers will be published in Science during the year.